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Smart Canteen Management System Based On Assistive Technology

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Abstract- The difficulties encountered in the canteen due to huge rush by visually impaired students in particular and by other typical students and employees, in general, is taken into consideration. Each user is recognised using face recognition technology. For the convenience of those who are blind, a voice-over system is employed to guide them through the buying process. Before collecting the food, a second interface is made available at the retailer to confirm the user's identification. The buyer will be provided with a special token number after pre-ordering the necessary meal packs. Additionally, the store can accurately quantify the number of packets needed, avoiding food waste
Keywords: Assistive Technology, Visually Impaired People

I. INTRODUCTION

The ultimate goal of the cashless canteen management system is to automate the manual, conventional system that is now in place with the aid of computerised equipment and feature-rich computer software. Speaking, typing, creating, remembering, directing, observing, listening, studying, moving, and doing a number of other duties are all challenging for troubled people. For a variety of disabilities, AT(Assistive Technology) is necessary. The fundamental objective of assistive devices is to care for or increase a person's capacity to function and be independent, hence increasing their overall satisfaction. They help people to live healthy, creative, autonomous, and meaningful lives while simultaneously engaging in school, employment, and civic life in a safe and secure setting. A wide term used to describe hardware and software that makes technology accessible to persons with impairments is assistive technology (AT). Screen readers, braille displays, and voice recognition software are the major AT for blind people.

Throughout the break, there is a long wait at the institution cafeteria. A lot of time is spent waiting for the meal, from the payment counter to the serving point, which causes students and faculty to be tardy for their studies. One solution would be to implement a software system that allows orders to be projected straight on the cafeteria monitor. We could even arrange for the computer to place orders in such a way that their order is processed and available for the time period that he or she chooses. Allowing online payment reduces the amount of time spent waiting for change.

All these technologies ensured that customers do not have to wait in line for long periods of time since orders are sent directly to the kitchen and orders are prepared ahead of time. Our plan makes it easy to deal with both the complicated operation of a cafeteria business and the problem of payments. Data migration to the cloud only needs to be done once. It completely automates the canteen business in colleges, institutes, and businesses. The current system is built on paper and cash. Due to the requirement that the consumer pays the exact amount and waits for the change, the payment process takes a long.

II. ASSISTIVE TECHNOLOGY

Assistive Technology (AT) refers to assistive, adaptive, and rehabilitative tools for the elderly and individuals with disabilities. Activities of daily living (ADLs) are tasks that disabled persons frequently struggle to complete without assistance. Toileting, mobility (ambulation), eating, drinking, bathing, dressing, grooming, and personal device maintenance are all considered ADLs.

Assistive technology encourages greater independence by enabling people to carry out tasks that they were previously unable to carry out or had a great deal of difficulty carrying out. This is done by improving the technology required to carry out these tasks or by altering the way in which people interact with them.

2.1 Visual impairments

Many persons with severe vision impairments maintain their independence while making use of a variety of equipment and methods. Screen readers, screen magnifiers, Braille embossers, desktop video magnifiers, and voice recorders are a few examples of assistive technology for those who are visually impaired.

2.2 Screen readers

The use of screen readers enables people who are blind to access electronic information with ease. These computer-based software packages enable low-vision persons to communicate with the presented information using voice (text-to-speech) or braille (refreshable braille displays) in some circumstances.

Apple VoiceOver, Google TalkBack, and Microsoft Narrator are a few screen readers. On all Apple devices, this program is available for free.

III. FACIAL RECOGNITION

A facial recognition system is a technology that can match a human face from a digital image or a video frame against a database of faces. It works by locating and measuring facial features from a given image and is often used to verify users through ID verification services. Facial recognition software tries to identify a three-dimensional human face that changes appearance depending on lighting and facial emotion based on a two-dimensional image.

Four stages are taken by facial recognition systems to solve this computational issue. To separate the face from the background of the image, face detection is used initially. In the second stage, the segmented face picture is aligned to take face posture, image size, and photography elements like lighting and grayscale into consideration. In the third stage, facial feature extraction, the alignment procedure's objective is to enable precise localization of facial features. The face's established feature vector is then matched against a database of faces in the fourth stage. In order to determine facial characteristics, it extracts landmarks, or features, from an image of the subject's face. For instance, an algorithm may consider the relative position, size, and shape of the eyes, nose, cheekbones, and jaw.

Haar Cascade is an Object Detection Algorithm that detects faces in images and real-time videos. To train the algorithm is given a large number of positive photos with faces and a large number of negative images with no faces.

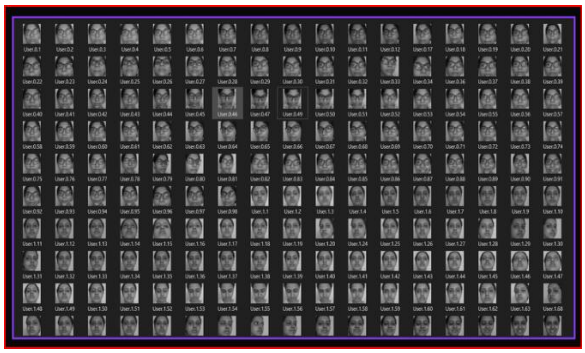

Fig.1: Dataset

3.1 Human Identification at a Distance (HID)

In order to make it easier for people to be recognised at a distance, it is used to enhance low-resolution photos of faces (HID). Resolution augmentation techniques have been created to enable facial recognition systems to operate using data captured in a high-signal-to-noise environment. t is applied to the image once the disguise, such as sunglasses, is removed and must be trained on comparable face images, both disguised and not. It is used to fill in the gaps left by removing the disguise, face hallucination algorithms need to correctly map the entire state of the face, which may be not possible due to the momentary facial expression captured in the low-resolution image.

3.2 3-Dimensional Recognition

Using 3D sensors, three-dimensional face recognition records details about a face's shape. Using this information, one may recognise distinctive features on the surface of a face, such as the shape of the eye sockets, nose, and chin. The fact that 3D face recognition is unaffected by changes in lighting, in contrast to previous systems, is one benefit. It can recognise a face from a range of perspectives, including a profile. Utilizing three-dimensional data points from a face significantly improves face recognition. Three cameras will

be placed: one in front of the subject, one to the side, and one at an angle. Together, these cameras will track a subject's face in real-time as well as identify and detect faces.

3.3 Thermal Cameras

In this situation, the cameras will simply identify the contour of the subject's head and ignore any subject accouterments like glasses, hats, or makeup. Thermal cameras are a novel method of acquiring data for face identification. In contrast to traditional cameras, thermal cameras may capture facial images at night and in low light without using a flash or disclosing the location of the camera.

IV. FACIAL DETECTION

Face detection, often known as facial recognition, is a computer approach that recognises and detects human faces in digital photos using artificial intelligence (AI). It can be utilized in various industries, including security, biometrics, law enforcement, entertainment, and personal safety, to enable real-time surveillance and tracking of people. Face recognition significantly affects the application's capacity to carry out subsequent tasks.

Face analysis uses a technique called face detection to choose which parts of a picture or video to study in order to identify age, gender, and emotions from facial expressions. The new faceprint can be compared to previously saved faceprints to check if there is a match. The eyes are one of the most easily recognisable features of a face, hence algorithms for detecting faces frequently start with them. The computer may then try to identify the eye, brows, lips, nose, and nostrils. After determining that a facial region has been discovered, the algorithm undertakes additional tests to confirm that it has correctly identified a face.

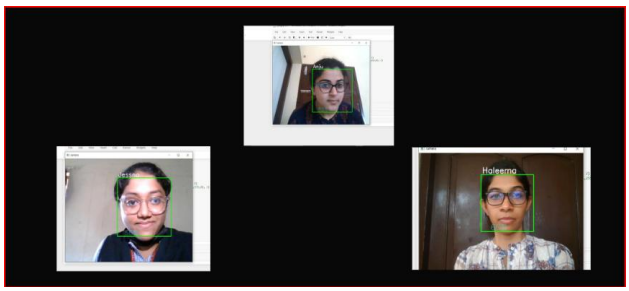

Fig.2: Face Detection

The Local Binary Pattern (LBP) is a primary yet effective texture operator that labels pixels in an image by thresholding the pixels' immediate surroundings and treating the output as a binary number. On some datasets, it was also discovered that combining LBP with histograms of oriented gradients (HOG) descriptors significantly enhances detection performance. We can represent the facial photos with a simple data vector using the LBP and histograms. Because LBP is a visual descriptor, it may also be utilised for face recognition tasks, as seen in the steps below.

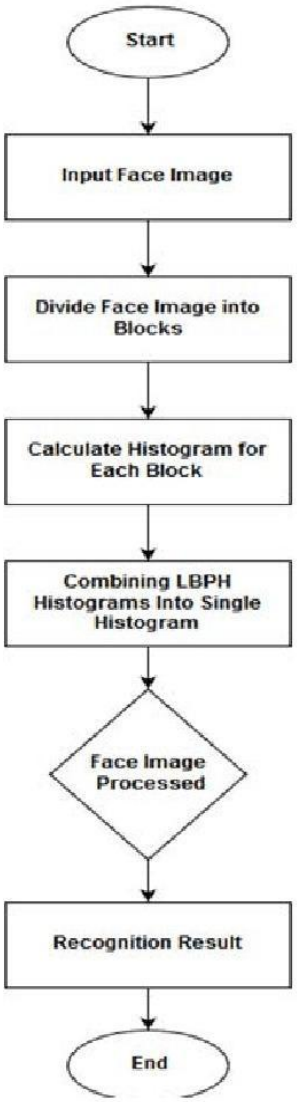

Fig.3: Steps involved in face recognition

4.1 LBP Operation

It is widely used in applications based on image processing. The LBP works in a block size of 3×3, in which the centre pixel is used as a threshold for the neighbouring pixel, and the LBP code of a centre pixel is generated by encoding the computed threshold value into a decimal value.

$$\mathrm{LBP} = \sum_{i=0}^{P-1} s(n_i - G_c)2^i$$

$$s(x) = \begin{cases} 1, & if\ x > 0 \\ 0, & otherwise \end{cases}$$

where *P* is the number of neighbouring pixels, *ni* represents the *i*th neighbouring pixel, and *c* represents the centre pixel. The histogram features of size 2*P* are extracted from the obtained LBP code. Hence, for eight neighbouring pixels, the histogram feature vector length of 256 is obtained.

The LBP operation is shown in Fig.4 with a Gc value of 10 and eight neighbouring pixels.

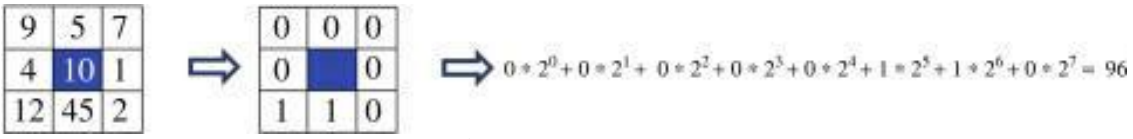

Fig.4: LBP operation

V. TEXT TO SPEECH

TTS (text-to-speech) is an assistive device that reads digital text out loud. It's also known as "read-aloud" technology. TTS may translate words on a computer or other digital device into audio with the click of a button or the touch of a finger. Practically every personal digital device, including PCs, smartphones, and tablets, is compatible with TTS. You can read aloud any sort of text file, including Word and Pages documents. Even online web pages can be read aloud.

The reading speed can typically be increased or decreased when using TTS, which employs a computer-generated voice. Although the voices' quality varies, some of them sound human. Even computer-generated voices that mimic children's voices exist.

5.1 pyttsx3

Python Library pyttsx3 is a Python-based text-to-speech conversion library. It operates offline, unlike other libraries, and is compatible with Python 2 and 3. To obtain a reference to a pyttsx3, an application calls the pyttsx3.init() factory method.

VI. SPEECH TO TEXT

It is a speech recognition application that recognizes spoken language and converts it into text using computational linguistics. It is also known as voice recognition software or computer recognition of speech. Specific programs, tools, and devices can instantly translate audio streams into text for display and action. The software listens to the audio and converts it into an editable, verbatim transcript that can be read on any device.

The simplest technique for doing recognition on speech audio data is to use the Speech-to-Text API synchronous recognition request. In a synchronous request, Spoken-to-Text can process up to 1 minute of speech audio data. Speech-to-Text responds after processing and recognising all of the audio. A synchronous request is a blocking request, which means Speech-to-Text must respond before moving on to the next one. Speech-to-Text typically processes audio quicker than real-time, taking about 15 seconds on average to process 30 seconds of audio. Your recognition request may take substantially longer if the audio quality is poor.

VII. HARDWARE AND SOFTWARE REQUIRED

7.1. Microphone

Sound waves present in the air are transformed into electronic signals with the help of a device called a microphone. These signals are then copied to a recording device or a loudspeaker. The microphone can be used individually or in combination with devices for example telephones and headsets. Capturing all the voices in a specific region is performed by omnidirectional microphones but they cannot focus on a specific voice from an individual subject in the presence of the background noise.

7.2. LED Screen

LED short for Light Emitting Diode, is a display made up of a combination of many light-emitting diodes which represent pixels used for a video. C. Software Required The software used in this project is Jupyter. The main goal of this software is to create open-source software, open standards, and facilities for interactive computing across many programming languages.

VIII. METHODOLOGY

We developed our Canteen Management System in three main stages. Our first step was collecting data on various human facial features and creating a dataset. The second phase involved programming and training it. We fed the system with a sample image showing different facial expressions concentrating on the regions of the face like eyes, nose, lips and also images showing different measurements. As a result when a visually impaired person whose data is already saved in the database will be detected automatically when he/she stands in front of the camera. Then the system will check the balance amount of the user in his account. We trained the system to start the conversation by reading out all the contents shown on the screen so that the user can place the order accordingly. As a result, the cash will be deducted from the user account and will update the total amount. After Placing the order the user will get a token no.

IX. RESULT AND DISCUSSIONS

The primary result is that the user is able to order the food item without any assistance from others.

9.1 Facial detection and recognition

In this part, the system uses the dataset that the user creates to determine the face and shape of the user. It is able to store the facial data of multiple users, who have to be named separately. We use a prebuilt function, known as the haar cascade classifier to determine a generic shape of a face and detect the boundary of the face. This boundary is then subjected to a photo shoot of n number of photos (in our example we use 100 photos). These photos are used to create the user's database. Every 100 photos are classified as a user, indexed

from 0 upwards.

9.2 Checking the balance status

The account balance of the user will be checked. If he has sufficient balance he can order the food item.If not the system will produce an alert voice.

9.3 Payment deduction and balance updating

Pyttsx3 python module are used for text-to-speech conversion. All the contents on the screen will be read out. Google Speech Recogniser is used to convert the user's speech to text. After getting the menu of the day, the user will order the food item and by confirming the order, cash will get deducted from his account and the balance will get updated.

9.4 Allocating the token number

After the successful order, the user will get a token no. with which he can have the food without any assistance from others.

X. CONCLUSION

We were able to deploy our project "Smart Canteen Management System Based on Assistive Technology," a next-generation food ordering solution in large-scale institutions such as offices, colleges, and schools, among others. Face identification and detection, as well as text-to-voice and speech-to-text conversion, were used to implement this technology/system. The system's user-friendly features also allow blind individuals to order food using AI, which will recognize whether the user is blind or not based on information provided at the time of registration. Because of the current circumstances, where social alienation is given top attention, this product will rise in relevance in the near future. The token-based method makes it possible to cut costs. The rush during the rush hours, will for l provide a unique token number and the table number which is vacant. The system has all the facilities for ordering food through mobile applications also.

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